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NEW MULTI-PLACE LIFE RAFTS A JUMP IN TIME FOR THE U.S. NAVY

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INTRODUCTION

The U.S. Navy requires all of its aircraft to carry life rafts with capacity equivalent to the personnel capacity of the aircraft. Ejection-seat aircraft are equipped with individual rafts as part of their ejection seat kits. However, other aircraft platforms have the option to carry combinations of four-, seven-, twelve-, or twenty-person rafts, depending upon the capacity of the aircraft and the availability of the different sized rafts. A team from the U.S. Naval Air Warfare Center-Aircraft Division at Patuxent River, Maryland evaluated the current rafts being used to meet this requirement. It concluded substantial improvements in both life cycle costs and performance could be accomplished. This paper describes the new rafts that resulted from the Team's efforts.

CURRENT MULTI-PLACE RAFTS

The Team first examined the U.S. Navy's future needs. It noted the declining use of the four-person rafts as well as the declining number of aircraft that commonly use those rafts. It was decided to exclude the four-person raft from the project. It also noted some new aircraft missions required eight- vice seven-person aircrews. It was therefore determined to qualify an eight-person to replace the current seven-person rafts. The twelve- and twenty-person sizes remained valid requirements.

The current 7-, 12-, and 20-person life rafts were designed in the 1950's. They are neoprene-coated cloth with cemented seams. The rafts have little protection within the current carrying cases and therefore require inflation checks every 224 days. Survivors find the rafts hard to board and offer little protection. The rafts are procured in accordance with detailed specifications that require the suppliers to build the rafts the same way every time, thus preventing the introduction of new designs, modern materials, and improved methods of construction. The specifications also require the use of ozone-depleting substances in their manufacture and in their subsequent repair.

USN SEARCH FOR NEW RAFTS

The team prepared program proposals and submitted them to two cost-reduction programs administered by the Naval Air Systems Command. Both proposals were approved and funded. The primary team was then formed and included one engineer, one logistician, and two engineering technicians. The latter were two retired U.S. Navy parachute riggers with over fifty years of combined Navy experience. The team drafted a new performance specification that was based upon the U.S. Federal Aviation Administration (FAA) specification TSO-C70a for aviation life rafts. The new specification included modifications intended to meet the special needs of naval aviation. A description of the modifications is provided below. The team then invited industry to submit sample rafts for testing to verify they meet the requirements of the specification.

PERFORMANCE SPECIFICATION REQUIREMENTS

The FAA specification was changed in both the performance and packaging areas but the rafts still had to be capable of receiving FAA certification. Some of the performance changes included:

- a) Improved "No Leak" Inflation System

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b) More personal space than required by the FAA specification. The rated capacity was changed from 3.6 to 4.5 square feet per person and with an overload capacity change from 2.4 to 3.0 square feet. This was intended to accommodate the average size of the aircrew and passengers while wearing their normal flight gear.

c) Fifty percent personnel overload capacity for each raft while maintaining adequate freeboard based on 200 lbs./person vice 170 lbs./person

d) Easily boarded by fully equipped aircrew

e) Self-erecting canopy

f) Decreased inflation times, especially in cold weather conditions

g) Insulated floor

h) Pull force to actuate the raft not to exceed 32 pounds

i) Packaged to fit through the U.S. Department of Defense regulation 22 inch square escape hatches

j) Means to collect rain water

k) Reflective strips

The packaging improvements required:

a) The raft assembly consists of three components including the vacuum packed raft, a separate bag for the accessory survival items, and a carrying case. The survival items are not included as part of the raft. The accessory kit container is not included inside the vacuum packaging so that life-limited components such as water and radio batteries can be inspected on a more frequent basis. This container is tied to the vacuum packed raft and must be pulled into the raft after actuation by the survivors.

b) The carrying case protect both the vacuum-packed raft and the packed accessory kit container from fluid intrusion and the normal wear and tear experienced in normal aircraft operations. The carrying case also had to provide a remote actuation lanyard.

c) The vacuum-packed raft had to withstand a five-year inspection cycle.

d) The accessory kit container had to be large enough to accommodate the U.S. Navy survival items with a ten percent allowance for additional items.

TESTING REQUIREMENTS

The rafts were subjected to three types of testing. The team conducted the initial tests in the NAWCAD Patuxent River laboratory to check packaging, weight, and size.

The Navy's water survival instructors and students at the Navy Operational Medicine Institute in NAS Pensacola, Fla. conducted the operational testing. They tested boardability and other issues associated with what a downed aircrew or passenger would experience in a survival situation. They paid special attention to the boarding ramps to ensure they would allow an injured survivor to board the rafts. The results of their testing were incorporated into the final raft designs. The U.S. Air Force water survival instructors also participated in some of the operational testing. They are currently reviewing the team's test data and are considering using the new rafts in some of their own aircraft.

A separate laboratory also at NAWCAD Patuxent River performed the final environmental testing. These tests were conducted in accordance with the U.S. Department of Defense specification MIL-STD-810 and included sand and dust, vibration, altitude, and temperature testing. The temperature tests included both a high temperature (160° F) and a low temperature (0° F) soak for 48 hours. Each soak was followed with a timed inflation to boardable shape that had to be completed within one and three minutes respectively.

RAFT SAMPLES

Two contractors submitted rafts for testing. Only the rafts submitted by the Air Cruisers Company of Belmar, New Jersey, U.S.A. successfully passed the required testing. They modified one of their commercial raft designs to meet the requirements of the performance specification.

ADDITIONAL RAFT FEATURES

These rafts are manufactured using heat-sealed, urethane-coated nylon with thermo-bonded seams. They are packaged in a clear, vacuum-sealed, flame-retardant, PVC bag. No ozone-depleting substances are used in their manufacture or repair. All three sized rafts share the same design differing only in their dimensions. Each vacuum-packed raft also includes a miniature accessory kit with a hand-pump to top off the raft and a patch for leaks for use during extended stays in the water. The kit also includes an instruction sheet for the survivors.

Air Cruisers Company satisfied the improved, "no leak" inflation system requirement by using a valve actuation system which does not depend on axial rubber o-rings for a seal. Instead, a machined stainless steel ball interfaces with a reinforced nylon seat to provide a large and robust sealing medium. This system met the temperature regime specified by performance specification.

The 8- and 12-person rafts achieve stability in the water with four attached ballast bags and a separate sea anchor. The 20-person raft is equipped with a sea anchor and six ballast bags. The rafts also have a righting aid which successfully allowed a fifth percentile individual to easily right all three sized rafts.

Two water-activated lights are provided with one outside and on top of the canopy and the other on the inflated canopy support beam. The raft canopy includes reflective strips that are easily removed if the aircrew wants to decrease its visibility. Low temperature testing demonstrated each raft size inflated to boardable shape within one minute.

The contractor workmanship warranties include an initial five-year warranty of all components and packaging. An additional warranty for the vacuum packaging is provided for three additional five-year repack periods.

Both the scheduled five-year inspections and unscheduled maintenance checks for when the vacuum seal is breached will be performed for the U.S. Navy by the contractor at their FAA-certified facilities in either New Jersey or California, U.S.A.

APPLICATION AND USEAGE

The U.S. Navy intends to introduce these rafts for its helicopter, P-3 and C-2 aircraft that are not equipped with ejection seats. Their use on C-130 aircraft is still being evaluated due to the peculiar wing mounting of its rafts.

While not a formal part of this program, some consideration has been given to their use in the SAR application. Although not required by the performance specification, the team successfully tested the stability of the rafts with a fifth percentile individual in the raft with a helicopter simulating a SAR swimmer drop. The team is considering testing the raft by air dropping it as part of a SAR rescue kit to determine how the raft and its self-erecting canopy will be affected during the drop and subsequent water landing.

SOURCES OF SUPPLY

The U.S. Navy will be introducing the new rafts on an attrition basis in the middle of 2000, since the type of funding received to conduct this program prohibits the acquisition of hardware. The rafts will not be provided through the regular U.S. Navy supply system. Instead the individual fleet activities will order the rafts and the inspection/repair directly from the contractor under a Federal supply schedule administered by the General Services Administration. This will reduce the cost to the fleet units, allow them to take advantage of the extensive

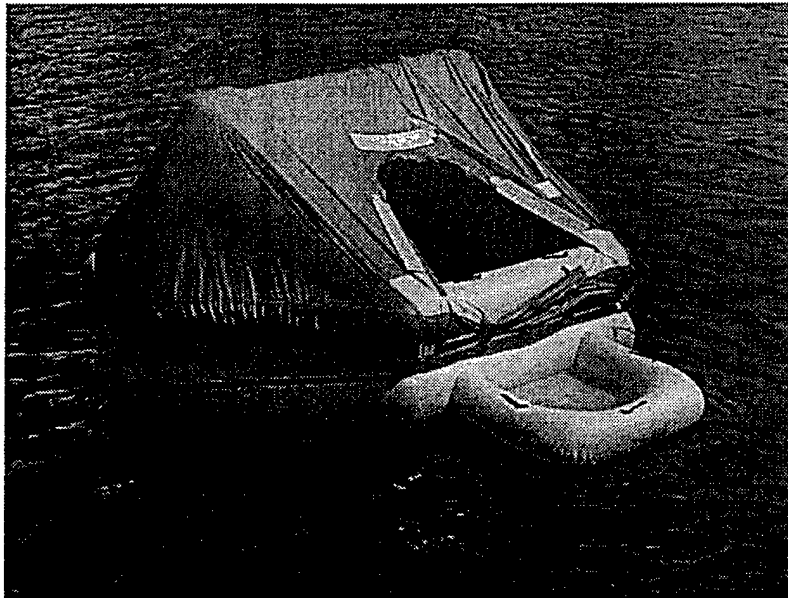
contractor warranty, and reduce the chance for out-of-stock conditions. This schedule is available to all U.S. government activities.

The rafts are also available commercially directly from Air Cruisers Company, P.O. Box 180, Highway 34 South & Allaire Airport, Belmar NJ. 07719-0180 USA. The phone number is (732) 681-3527.

BENEFITS TO THE U.S. NAVY

The Navy plans to introduce the new rafts to the fleet on an attrition basis at a rate of 8-9 percent per year. Even at this rate, the man-hours saved by avoided scheduled fleet inspections should be in excess of \$77,500 within the first seven years. The three raft sizes should provide individual savings of \$1,853, \$7,693, and \$2,907 per raft over the minimum expected raft service life of twenty years. Based upon its total raft population, the Navy anticipates a total savings of over \$9,907,968. These figures do not even consider the value of the additional lives saved as a result of improved performance.

With improved performance and reduced life cycle costs, the U.S. Navy wins both ways.



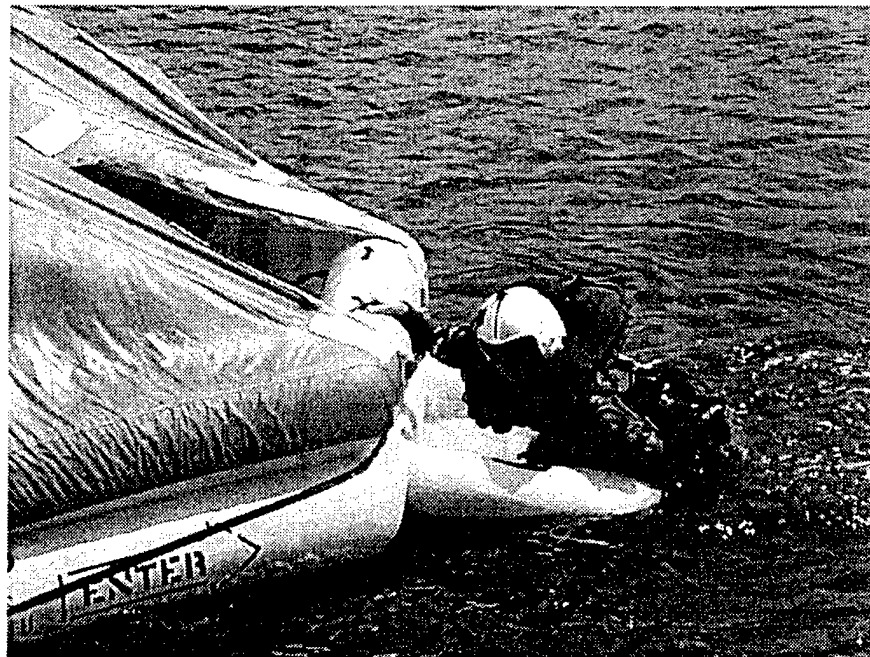
New Design Rafts



CURRENT 7 MAN RAFT



CURRENT 20 MAN RAFT



USN AIRCREW BOARDING THE NEW RAFT